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EXTRACTS FROM REFERENCES IN AVAILABLE LITERATURE PERTAINING TO SPLEEN EXAMINATIONS IN MALARIA.

In connection with the spleen examinations of school boys in Mitchell County, Ga., recently reported by Special Expert M. A. Barber and Acting Assistant Surgeon C. P. Coogle, United States Public Health Service,¹ the following review of available literature pertaining to spleen examinations in other countries has been prepared at malaria field headquarters. It is felt that the employment of spleen examinations, particularly among school children, may be a simple measure of easy application for the determination of malaria prevalence, a measure which, perhaps, has not received anywhere in the United States the attention to which it is entitled. It is hoped that through the State and local health authorities, spleen examinations of from 50,000 to 100,000 school children can be secured during 1921, in widely separated sections of the United States. These spleen examinations will be checked by other methods of determining malaria prevalence; and it is believed that a careful study of the findings will enable us to determine whether this procedure, which is so easy of application, can be employed as a satisfactory measure of malaria prevalence in the United States.

In ascertaining the prevalence of malaria in any locality, Stephens and Christophers (1904) state as follows relative to the importance of spleen examinations:

The method of determining to what extent enlargement of the spleen occurs has been largely used. Spleen enlargement due to ordinary malarial infection tends to disappear, once the individual has ceased to suffer from the disease. In very malarious countries, where each individual, after childhood, has become highly immunized, the adult population usually shows no splenic enlargement. In less malarious regions the adults have not become highly immunized, and a certain percentage of them will be found with enlarged spleens and malarial infection. The use, then, of the percentage of adults with enlarged spleens is not a reliable method of determining the real intensity of malaria.

In children the spleen enlargement appears to require a certain time to become apparent, and it takes a certain time to disappear as the malarial infection disappears with ensuing immunity. In the examination of children we find—

In the early ages, 1 to 2 years, the number infected is usually in excess of those showing splenic enlargement.

Above 2 years the spleen rate is usually somewhat in excess of the parasite rate.

Above 10 years, the spleen rate is usually considerably in excess of the parasite rate.

¹ Public Health Reports, Apr. 8, 1921, pp. 706-710.

In the use of a spleen census one should then avoid a mixed adult and child count, and children between the ages of 2 years and 10 years should be chosen.

It seems clear that the comparison of the malaria prevalence in widely different regions, by means of the percentage of enlarged spleens in the children, is not possible. It has been found, however, in some tropical regions, like Bengal, that the parasite rate and spleen rate in children vary proportionately. Here the spleen rate was always about double that of the parasite rate. (Stephens, J. W. W., and Christophers, S. R., *The Practical Study of Malaria*, pp. 263-4. The University Press of Liverpool, London, 1904.)

James (1920), in describing his methods of studying endemic malaria in the Tropics, relates the following as the manner of obtaining the spleen rate:

In villages in the Tropics it is seldom difficult, after the objects of the inquiry have been tactfully explained to the people, to collect a crowd of children who, by the distribution of sweets or coppers, can be persuaded to submit to clinical examination with a view to ascertaining the presence and degree of splenic enlargement. The examination should be carried out as thoroughly as circumstances permit, but it nearly always has to be made while the child is in the erect posture. The size of the spleen should be stated as being one, two, three, etc., fingers' breadth below the edge of the costal margin.

The term *splenic index* is used to denote the percentage of children between the ages of 2 and 10 years who have enlarged spleens due to malaria; however, in field work it is best not to limit the examination of children to those ages, but to examine all people who will permit it. It is often quite as important to know the adult spleen rate in a community as it is to know the rate in children. (James, S. P., *Malaria at Home and Abroad*, p. 96. Bale & Danielsson, London, 1920.)

Ross (1910), in his chapter on malaria in the community, gives concretely the advantages and defects of the spleen rate relative to the index in malaria. He treats of the subject as follows:

It is known that the spleen enlarges sufficiently to be detected by palpation in a considerable proportion of infected persons. Such enlargement is discoverable with certainty and in a few seconds by the fingers pressed under the ribs of the left side, and anyone—hospital assistants, nurses, and laity—can detect it. The persons to be examined are passed in a line before the examiner, while another person records the results; and with good management 100 people can be thus inspected in an hour, or else one can do the work by house to house inspection.

The method is open to the following defects:

(a) The enlargement may be so slight in a small proportion of cases, especially in early infections, that it may be overlooked in

them if we use palpation only. Generally, however, there is fever, or a history of recent fever, in such cases.

(b) The spleen of healthy infants is sometimes so easily palpable that the unskilled observer may think that it is enlarged.

(c) Not all infected persons show palpable spleens.

(d) Not all splenomegalous persons are necessarily infected. Generally speaking, however, widespread splenomegaly is due to malaria.

The advantages of the method are: (1) That the enlargement can be detected, practically with certainty and in a few seconds, by almost anyone; (2) that the method can be applied with little trouble to enormous numbers of people, thus practically avoiding the error of random sampling.

We must note that a smaller degree of splenic enlargement can be detected by percussion (as practiced by medical men) than merely by palpation. By the former method we can nearly always detect some enlargement in malaria. On the whole, we can conclude that some degree of splenic enlargement probably exists in 95 to 100 per cent of all persons infected with malaria, but that the enlargement is great enough to be palpable only in about 75 to 90 per cent of cases.

Thus, by the term *splenic index* is generally meant the percentage of persons in whom enlargement is detectable by palpation only.

In what proportion of persons with enlarged spleen are there no plasmodia at all? It is impossible to say; but we may give 20 per cent as a rough conjectural estimate.

It would thus seem that the spleen index is much nearer the truth than the parasite index, provided that the splenomegaly is really due only to the malaria.

The number of persons with parasites, but without splenomegaly, seems to be an important figure, because such cases are due to recent infections, before the spleen has had time to become enlarged—especially in children.

The average spleen enlargement depends not only on the degree of enlargement but also on the proportion of infected persons (general malaria rate), and may be looked upon as an index of the average amount of illness caused by malaria in the community. The average enlarged spleen indicates only the degree of enlargement, where it exists. Several useful deductions may be drawn from figures: Thus, numerous small enlargements would tend to indicate many recent infections; and numerous large ones with few small ones, a past epidemic.

“Generally considered, the study of the splenic enlargement, so important for public health work, has been curiously neglected in medical literature.”

Ross concludes that, as a general rule, the spleen index (obtained by palpation only) is by far the best method of measurement in determining the degree of endemic malaria. It requires no great skill; it can often be applied to almost all the people in a community; and it should yield by itself a very nearly correct measure of the actual malaria rate. As a rule, local conditions, race, and complicating diseases are likely to cause a percentage of error far smaller than that due to the insufficient random sampling which must always attend the laborious estimation of the parasite index (the advocates of which frequently overlook this important point). (Ross, R., *The Prevention of Malaria*, pp. 220-224. John Murray, London, 1910.)

Daniels and Newham (1911), in discussing the endemic index in malaria, give the value of the splenic index in the following statement:

The spleen test, or the proportion of persons with enlarged spleens, is useful if age and race are taken into account. It is of more value amongst Negroes than amongst other races, as the Negro spleen does not continue to enlarge after immunity has been acquired, in the same way that the spleens of many individuals of other races do. The test can be used easily, as there is nothing in the examination to excite, alarm, or frighten children, and can be made more quickly than any other examination.

It indicates only antecedent, probably remote, infection, and is less certain proof of antecedent infection than the presence of parasites. A large proportion with enlarged spleens between 2 and 5 years of age is an indication of a high endemic index. If the presence of malaria in a district is proved, the absence of enlarged spleens in Negro adults or a low proportion between 10 and 15 years of age is equally a proof of high endemic index; whilst if the proportion of enlarged spleens in adult Negroes is appreciable, or large in those between 10 and 15, the endemic index is low. It is noted, however, that with no other race but the Negro can such conclusions be drawn with certainty.

The determinations obtained by the spleen test are less likely to be influenced by meteorological conditions than the test by blood examinations; they are easier to make and can be made in a larger number of cases, but otherwise are less accurate, as the conditions that lead to splenic enlargement after malarial infection vary and are not thoroughly understood, and splenic enlargement in a varying proportion is due to other causes. (Daniels, C. W., and Newham, H. B., *Laboratory Studies in Tropical Medicine*, 3d edition, p. 463. Bale & Danielsson, London, 1911.)

Daniels (1913) asserts that the test of the prevalence of enlarged spleen has fallen undeservedly into disuse on account of the manner in which it was at one time abused in India by the laity as well as by medical men. With the following limitations it is of considerable

value: That other diseases are also causes of enlargement of the spleen and that, therefore, where these diseases are prevalent, the value of the test is greatly reduced; that the examination should be limited to children, as in adults of other races, East Indians, etc., chronic enlargement of the spleen, whether as the result of early infection of malaria or not, persists throughout adult life, and may even increase.

With Negro races the results obtained by the spleen test are of high value. With other races, only the examinations made of children up to 15 years of age are valuable.

The advantages of the method of spleen examination are that: (1) There is less opposition to palpation of the abdomen in children than to blood examination; (2) that the examinations can be made more quickly than the examination of blood for parasites and far more quickly than differential leucocyte counts; (3) that with little training, moderately reliable results may be obtained by trustworthy men with no medical education; (4) that the condition of the spleen does not vary so rapidly as the number of parasites in the blood. Thus a spell of cold or wet weather will often result in an increase in the proportion of persons in whose blood the parasites are sufficiently numerous to be readily found, whilst the probabilities of a new infection are not affected by such meteorological changes. The size of the spleen is affected by such changes to a very slight extent. (Daniels, C. W., *Tropical Medicine and Hygiene*, 2d edition, pp. 83-84. Bale & Danielsson, London, 1913.)

Deaderick and Thompson (1916) state, relative to spleen rate and the endemic index, that they believe that the spleen rate would not disclose the true endemic index of regions in the southern United States. They note that elsewhere the prevalence of splenic enlargement has been employed to calculate the extent of paludism, this method requiring much less time than the examination of the blood. In their experience the spleen rate and the endemic index estimated by a microscopic examination of the blood do not usually correspond even approximately.

Quoting Stephens and Christophers, a selection of seven localities in India gave an average spleen rate of 31.46 and a corresponding parasite rate of 14.4. (Deaderick, Wm. H., and Thompson, L. T., *The Endemic Diseases of the Southern States*, pp. 38-39. 1916.)

DEATHS DURING WEEK ENDED APR. 9, 1921.

Summary of information received by telegraph from industrial insurance companies for week ended Apr. 9, 1921, and corresponding week, 1920. (From the "Weekly Health Index," Apr. 12, 1921, issued by the Bureau of the Census, Department of Commerce.)

	Week ended Apr. 9, 1921.	Corresponding week, 1920.
Policies in force.....	46, 505, 524	42, 871, 031
Number of death claims.....	9, 592	8, 878
Death claims per 1,000 policies in force.....	10.8	10.8